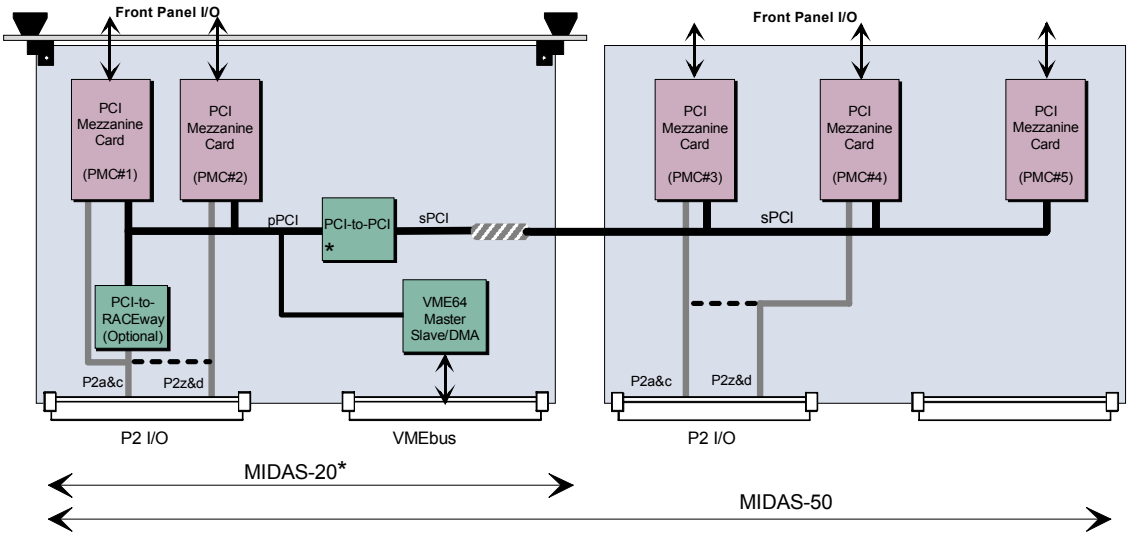
User's Manual

MIDAS-20/20R
MIDAS-50/50R

PMC Carriers for VMEbus and RACEway

Valid for MIDAS-20 PCB-C

Rev. 1.7



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General Information

This document

This document has been prepared to help the customer in the integration of the products MIDAS-20/20R and MIDAS-50/50R in their system.

The following models are covered by this document:

MIDAS-20: Dual PMC Carrier for VMEbus.

MIDAS-20Z: Dual PMC Carrier for VMEbus, with 5 row DIN connectors

MIDAS-20R: Dual PMC Carrier for VMEbus, with an interface to the RACEway crossbar interconnect.

MIDAS-50: PMC Carrier for VMEbus, capable of carrying up to 5 PMC modules.

MIDAS-50R: PMC Carrier for VMEbus, capable of carrying up to 5 PMC modules, with an interface to the RACEway crossbar interconnect.

During this document, the generic name “MIDAS” refers to all models whenever their common features are described.

Conventions used in this document

The following section describes conventions used in this document.

Symbols	*Meaning:*
	The STOP symbol indicates a section of critical importance. Overlooking this information may cause damage to the MIDAS and/or other equipment.
	Indicates important, but not crucial information. Still, you should take notice if you want to use all capabilities built into your MIDAS.

Related Documents

This document does not include detailed information about the 'Universe II', VME-to-PCI bridge chip, the 21152 PCI-to-PCI bridge and the PCI-to-RACEway interface chip; the PXB. A majority of the control registers and a large part of the complexity of the products is implemented in these chips. The documents related to these chips contain essential information for understanding the products. The following documents can be provided directly from the chip vendor (also available on the internet):

Tundra Semiconductor Corp.: **UNIVERSE II USER MANUAL**
http://www.tundra.com/

INTEL: **21152 PCI TO PCI BRIDGE**
http://www.intel.com/design/bridge/datasheets/

Information should also include updated information on device errata.

A copy of the documents listed above along with the **PXB BRIDGE SPECIFICATION** can be obtained directly from VMETRO[1].

[1] MIDAS Doc. Kit.

Product Overview

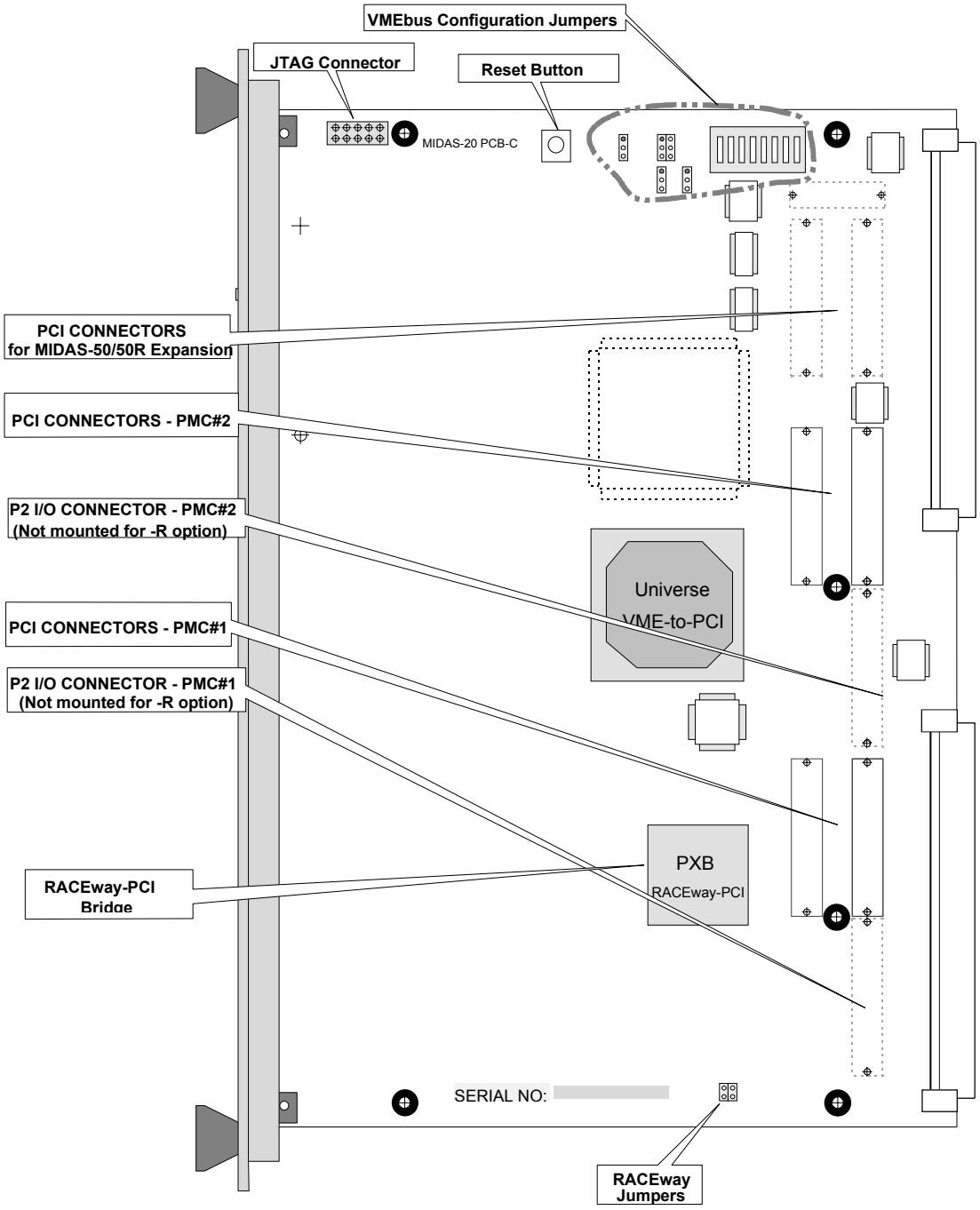


Figure 1. MIDAS-20R board layout. Expantion connectors and the PCI-to-PCI bridge are mounted only on the MIDAS-50/50R mother board.

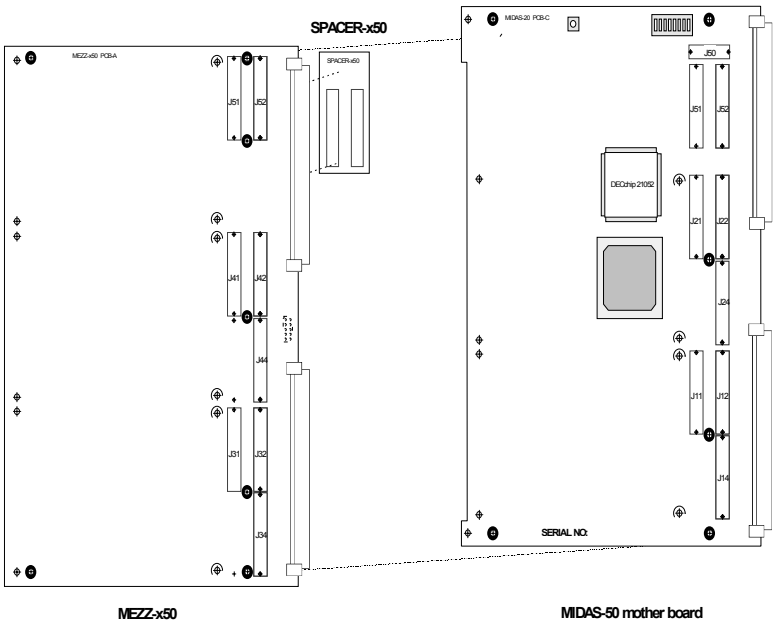


Figure 2. MIDAS-50: MEZZ-x50 + SPACER-x50 + MIDAS-50 mother board

MIDAS-20/20R

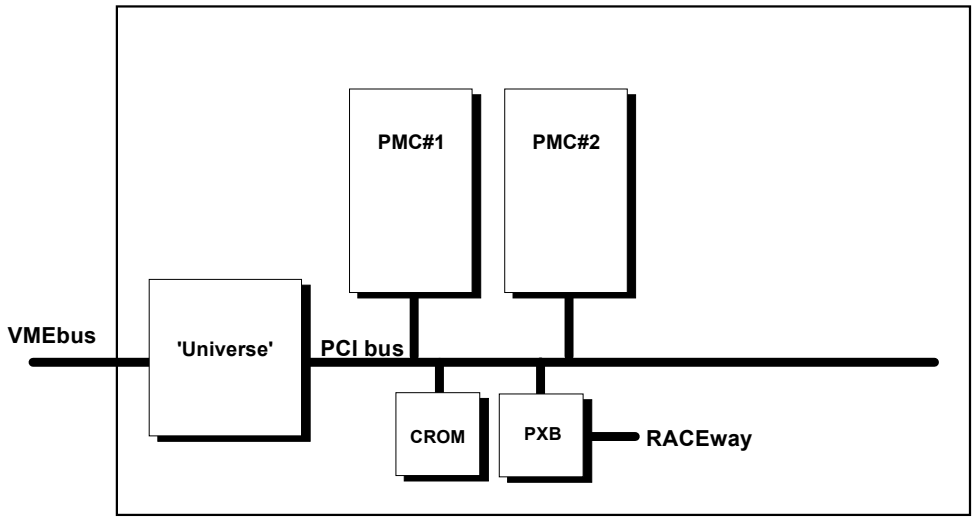


Figure 3. MIDAS-20R Block Diagram

The MIDAS-20 is a PMC carrier for VMEbus . The MIDAS-20R option, contains the PCI-to-RACEway interface chip; the PXB. The MIDAS-20/20R with the PCI-to-PCI bridge and the expantion connectors mounted on it provides the mother board for the MIDAS-50/50R.

MIDAS-50/50R

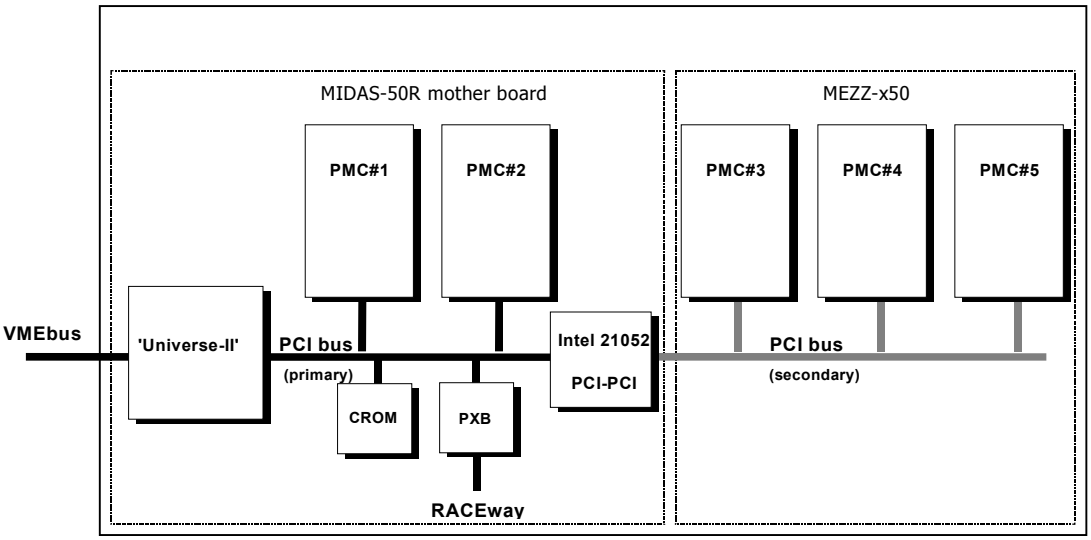


Figure 4. MIDAS-50R Block Diagram

The MIDAS-50 is a PMC carrier VMEbus board which supports up to five PMC slots. The MIDAS-50R option, contains the PCI-to-RACEway interface chip; the PXB. The MIDAS-50 occupies two VMEbus slots.

Installation

Board Precautions

The circuit boards are sensitive to static electricity and can be damaged by a static discharge. Always wear a grounded anti-static wrist strap and use grounded, static protected work surfaces when touching the circuit boards and their components.

When the board is not installed, always keep it in its static-protective envelope.

Unpacking

All precautions described above must be taken when unpacking the product from its shipping container(s). Verify that no damage has occurred in the shipment. Verify that all items are present:

MIDAS-20/20R:

- One MIDAS-20/20R board.
- This manual.

MIDAS-50/50R:

- One dual slot VMEbus plug-in unit consisting of:
  - One MIDAS-50/50R mother board.
  - One MEZZ-x50 board.
  - One SPACER-x50 board.
  - Five metal spacers.
- This manual.

Installation of PMC Modules

The MIDAS-20/20R and MIDAS-50/50R are shipped with PMC filler panels mounted in the front panel. They act as EMC shielding in unused PMC positions. Before installing a PMC module the filler panel(s) must be removed. This is done by pushing them out from the back side of the front panel.

Please refer to assembly procedures below for further instructions on the installation of PMC modules.

Assembly Procedure for MIDAS-50/50R

The MIDAS-50/50R is a dual slot VMEbus board which mates the backplane connectors in two neighbor slots. The MIDAS-50/50R module can handle the insertion and extraction forces applied when installing or removing it from the backplane. However, this requires that the assembly procedure described in this section is followed.

WARNING: The MIDAS-50/50R boards may be destroyed during insertion or extraction from a VMEbus system if this procedure is not followed.

STEP#1: **Dismount MEZZ-x50 board from MIDAS-50/50R board.**

- Place the MIDAS-50/50R board on a smooth static protected work surface with the bottom side of the board facing up.
- From the bottom side of the MIDAS-50/50R PCB, unscrew the 5 screws holding the metal spacers between the MEZZ-x50 and the mother board. (these screws are located close to the edge of the board in each corner, and between the VMEbus connectors). **Note:** Don't throw away the screws. They are needed later in this procedure.
- Pull the boards carefully apart. Use hand force only, applied to the two the upper VMEbus connector of both boards.
- If the small SPACER-x50 PCB is attached to the MIDAS-50/50R mother board PCB after the separation, remove it and mount it on the bottom side of the MEZZ-x50 board instead.

STEP#2: **Mount PMC modules 1 and 2 on the MIDAS-50/50R mother board.**

- Place the MIDAS-50/50R mother board on a smooth static protected work surface.
- Install PMC module #1 in the lower PMC position
- Install PMC module #2 in the upper PMC position
- Secure PMC modules with screws from the bottom side of the mother board.

STEP#3: **Mount PMC modules 3, 4 and 5 on the MEZZ-x50 board.**

- Place the MEZZ-x50 board on a smooth static protected work surface.
- Install PMC module #3 in the lower PMC position
- Install PMC module #4 in the middle PMC position
- Install PMC module #5 in the upper PMC position
- Secure PMC modules with screws from the bottom side of the MEZZ-x50 board.

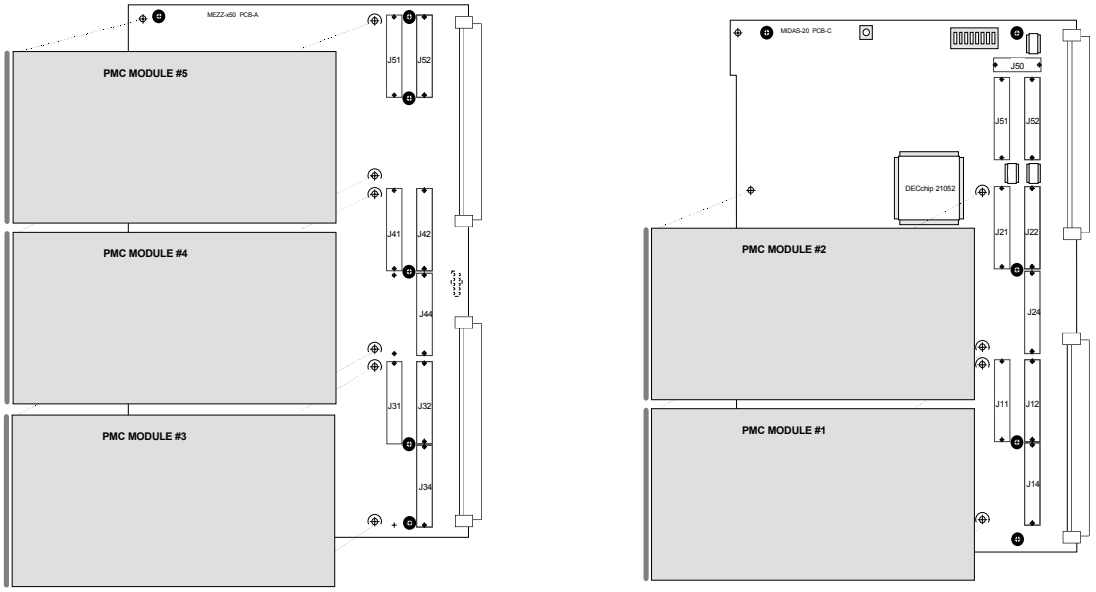


Figure 5. Steps 2&3: Mount PMC modules on the MEZZ-x50 and the MIDAS-50 mother board.

Note: Before proceeding, make sure that the switch and jumper settings on the MIDAS-50/50R mother board is according to the needs of your application.

STEP#4: **Mount MEZZ-x50 with PMC modules on the MIDAS-50/50R mother board.**

- If the SPACER-x50 board and the five metal spacers are not already mounted on the bottom side of the MEZZ-x50 board, do it now.
- Place the MIDAS-50/50R mother board on a smooth static protected work surface.
- Carefully position the MEZZ-x50 board over the MIDAS-50/50R mother board, so that the three connector on the bottom side of the spacer are aligned with the connectors J50, J51 and J52 on the MIDAS-50/50R mother board. **Make sure that neither of the five metal spacers mounted on the MEZZ-x50 board touches components or component leads on the MIDAS-50/50R mother board in the process.**
- Push the MEZZ-x50 board down so that all connectors mate completely.

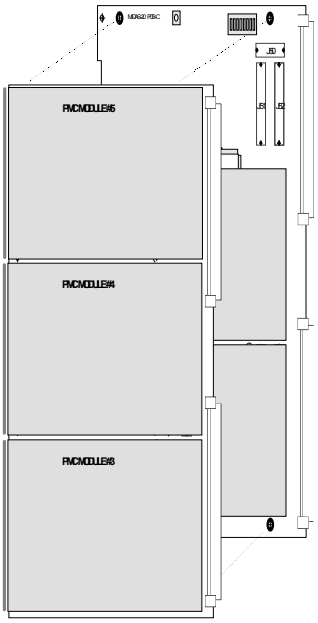


Figure 6. Step 4: Mount the MEZZ-x50 with PMC modules on the MIDAS-50/50R mother board.

STEP#5: **Mount and fasten screws to all metal spacers from the back of the MIDAS-50/50R mother board.**

- Take the 5 screws removed in step#1 of this procedure, and mount them from the back side of the MIDAS-50/50R mother board through the holes which mate the 5 metal spacers on the MEZZ-x50.
- Fasten all five screws with a suitable screw driver.
- Verify that the screws attaching the metal spacers to the MEZZ-x50 are also fastened.
- **All screws holding the five metal spacers from both boards must be firmly fastened in order to make the MIDAS-50/50R mechanically stable.**

Installation in VMEbus System

Slot selection

The MIDAS can be installed in any slot in a 6U VMEbus chassis **as long as the daisy-chains for the bus grant and interrupt acknowledge signals are continuous from slot#1** to the slot in which the board is installed.

If the MIDAS is installed in slot#1 of a VMEbus system it will automatically detect this as specified in the VME64 specification and enable its system controller functions.

WARNING: Do not install the board in a powered system!

MIDAS-50 Daisy-Chain

The P1 connector of the MEZZ-x50 provides a daisy-chain bypass for the signals BG[3:0]* and IACKIO*. No action is therefor required to keep the daisy-chain continuous through the MIDAS-50/50R board.

Power consumption

Model	Typical current consumption (5V)	Test condition
[1)]M20	0.5A	Board idle
	1.0A	Board active
[1)]M20R	1A	Board idle
	1.8A	Board active

Table 1: Power consumption

PMC current supply capabilities

The MIDAS M20x has the ability to power both 5 and 3.3 Volt PMC modules with the following limitations.

Voltage	Maximum current	Additional information
[2)]3.3	[1)] 4A	Max. total current
5	*Supplied from VME backplane.*	Refer to PMC standard.

Table 2: Current supply Capabilities

[1)] Note: as 3.3V is supplied by a linear regulator mounted on the MIDAS, additional current drawn from 3.3V has a direct effect on the 5 Volt power consumed.

[2)] 3.3 Volt capabilities available on MIDAS 20 with ECO level C.3 or higher.

Configuration Switch & Jumpers

The VME-PCI bridge on the MIDAS-20/20R and MIDAS-50/50R boards has a number of configuration registers which need to be initialized before the bridge is fully operational. This initialization is done by a host processor residing either on VMEbus or on the local PCI bus. This host is normally on VMEbus.

The switch and jumpers cannot alone be used to initialize the MIDAS board. They are used to define **how** (base address, address space etc. for initialization) the initialization is done.

Note: When the Auto-Slot ID feature is enabled, the MIDAS board asserts IRQ2* on VMEbus reset.

Auto-Slot ID

Plug&Play

The MIDAS has full support for the Auto-Slot ID mechanism as defined by the VME64 specification. By use of the daisy-chained IACK signal, CR/CSR space accesses are enabled for one VME slot at a time. Thus, the "Monarch" (host for initialization) is able to recognize installed modules and initialize them to achieve Plug&Play VMEbus systems.

The board is shipped with a jumper setting in which Auto-Slot ID is enabled. This means that MIDAS can be plugged directly into PnP VMEbus systems without moving jumpers.

VMEbus Switch & Jumper Descriptions

MIDAS has one DIP switch and five jumpers used for VMEbus configuration.

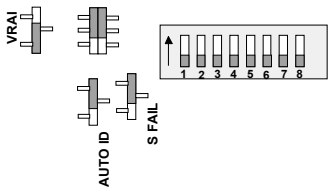


Figure 7. MIDAS Configuration Switch and Jumpers (Auto-Slot ID settings shown)

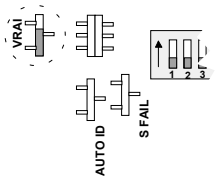
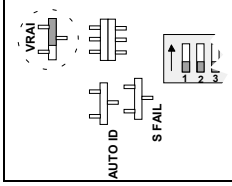
Switch & Jumpers for "manual" configuration.

The DIP-Switch and three of the jumpers are of this category. Unless the Auto-Slot ID protocol is used by the host system (see section above, and descriptions below) these switch/jumpers should be used to define a window in the VMEbus address space for configuration of the VME-PCI bridge on MIDAS.

VME Register Access Image - ENABLE/DISABLE

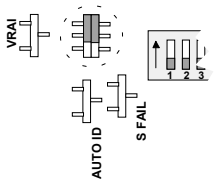
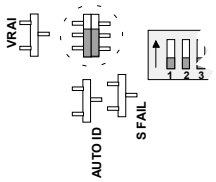
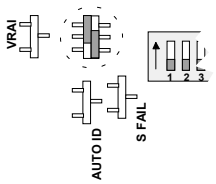
The *VME Register Access Image (VRAI)* permits accesses from VMEbus to the VME-PCI bridge internal registers at power-up. Unless the Auto-Slot ID protocol (which uses its

own slave image) is used, this slave image must be enabled to allow initialization from VMEbus.

	DOWN: VME Register Access Image DISABLED.
	UP: VME Register Access Image ENABLED.

VME Register Access Image (address size)

The *VME Register Access Image* can accept A16, A24 or A32 AM codes depending on the positioning of these two jumpers. At power-up this slave image accepts AM codes for: Supervisor, User, Data and Code.

	UP/UP: VME Register Access Image A24.
	DOWN/DOWN: VME Register Access Image A32.
	UP/DOWN: VME Register Access Image A16.

VME Register Access Base Address

The DIP switch is used to define the base address for the *VME Register Access Image.* The size of this image is fixed to 4KB.

VRAI Addr. Size	BASE ADDRESS BS[31:24]	BS[23:16]	BS[15:12]
A16	N.A.	N.A.	From switch (4 MSB)
A24	N.A.	From switch	0x00
A32	From switch	0x00	0x00

Table 3. VRAI Base Address Definition

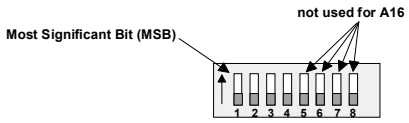


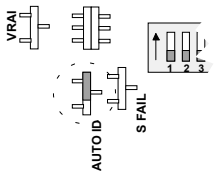
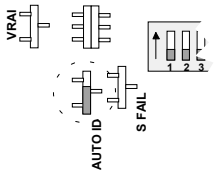
Figure 8. DIP Switch Details.

VME64 Auto-Slot ID - ENABLE/DISABLE

By the use of a new address space for CR/CSR accesses, the VME64 specification defines a method for implementing Plug&Play on VMEbus called Auto-Slot ID. The AUTO ID jumper controls the enabling of the VME64 Auto-Slot ID mechanism.

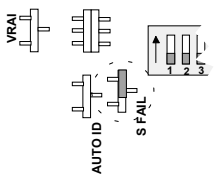
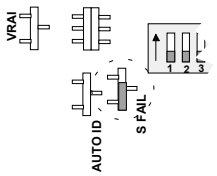
Note that to fully support Auto-Slot ID the "Monarch" needs access to Configuration ROM data located on the PCI bus.

Note: When the Auto-Slot ID feature is enabled, the MIDAS board asserts IRQ2* on VMEbus reset.

	UP: VME64 AUTO-SLOT ID ENABLED.
	DOWN: VME64 AUTO-SLOT ID DISABLED.

SYSFAIL Assertion*

This jumper can be used to make the Universe assert SYSFAIL* upon reset/power-up. Normally this option should be disabled (Jumper in its upper position).

	UP:	SYSFAIL ASSERTION DISABLED.
	DOWN:	SYSFAIL ASSERTION ENABLED.

RACEway Interface Jumper Descriptions

The MIDAS-20R/50R models incorporate the PXB chip, a PCI-RACEway bridge developed by Mercury Computer Systems[2].

MIDAS has two jumpers for configuration of the RACEway interface. They are located close to the bottom edge of the board, indicated with silk-screen text: RACEWAY. As explained in the description below, both RACEway jumpers are removed during normal operation.

No EEPROM

When the *No EEPROM* jumper (leftmost RACEway jumper) is removed, the PCI-RACEway bridge chip loads its internal registers from a serial EEPROM. This setting should always be used, except for cases where the PROM is blank or corrupted.

If the PROM is corrupted, and this jumper is removed, the PCI-RACEway bridge may reset to a state which causes the MIDAS board (in worst case the entire system) to hang.

If the *No EEPROM* jumper is inserted, the PCI-RACEway bridge reset state is independent of the PROM contents. This setting is normally used for the initial programming of the PROM or if the board is plugged into a non-RACEway slot. Note that before programming the PROM, the PXB must be set in *bridge mode*.

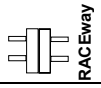
	Inserted:	PXB registers not loaded from EEPROM.
	Removed:	PXB registers loaded from EEPROM.

[2] For more information about this chip and some configuration examples, please refer to Appendix IV.

Reset from X

When the *Reset from X* jumper (rightmost RACEway jumper) is removed, the PCI-RACEway bridge receives reset from PCI bus (i.e. MIDAS reset circuitry), and drives reset to the RACEway interlink. This setting should always be used.

Inserting this jumper may be destructive for the MIDAS board, and is likely to cause system malfunction.

	Removed: This setting should always be used.

Functional Description

PCI Bus 'IDSEL' Generation

PCI bus uses a separate address space for initialization called *Configuration Space*. This address space uses a geographic addressing signal; IDSEL to select target for all transactions. The standard way of assigning IDSEL to PCI devices & boards is to connect the IDSEL pin of each device/board to a unique AD[ ] bit.

This is also how IDSEL is generated on MIDAS. The table below shows IDSEL assignments.

PCI DEVICE/BOARD	IDSEL	PCI ADDRESS FOR CONFIG. CYCLE	VME BASE ADDRESS FOR PCI CONFIG. CYCLE
PMC # 1	AD[16]	0x00010XXX	0xYYZZ2800
PMC # 2	AD[17]	0x00020XXX	0xYYZZ3000
PCI-to-PCI Bridge[3]	AD[20]	0x00100XXX	0xYYZZ4800
PXB PCI-RACEway[4]	AD[19]	0x00080XXX	0xYYZZ4000
VME-PCI BRIDGE	AD[31]	0x80000XXX	

'ZZ' = PCI Bus Number (as defined in Universe MAST_CTL register)
'YY' = VME base address for slave image

Table 4. IDSEL Assignments for Primary PCI Bus

PCI DEVICE/BOARD	IDSEL	PCI ADDRESS FOR CONFIG. CYCLE	VME BASE ADDRESS FOR PCI CONFIG. CYCLE
PMC # 3	sAD[16]	0x00010XXX	0xYYWW0000
PMC # 4	sAD[17]	0x00020XXX	0xYYWW0800
PMC # 5	sAD[18]	0x00040XXX	0xYYWW1000

'WW' = PCI Bus Number for secondary bus (as defined in the PCI-to-PCI bridge)
'YY' = VME base address for slave image

Table 5. IDSEL Assignments for Secondary PCI Bus on MIDAS-50/50R

Interrupt Routing

The VME-PCI bridge provides eight bi-directional interrupt pins to the local bus interface. Their routing to PMC interrupt pins is shown in the tables below:

[3] The P2P bridge is only present on the MIDAS-50/50R mother board.
[4] The PXB chip is only present on the MIDAS-20R/50R model.

For details on setting up interrupt channels, please refer to the UNIVERSE II USER MANUAL.

UNIVERSE INT.	PMC # 1	PMC # 2	PMC # 3	PMC # 4	PMC # 5
LINT#[0]		INTA#			
LINT#[1]	INTA#				
LINT#[2]		INTB#			
LINT#[3]	INTB#				
LINT#[4]		INTC#	INTA#	INTC#	INTB#
LINT#[5]	INTC#		INTB#	INTD#	INTC#
LINT#[6]		INTD#	INTC#	INTA#	INTD#
LINT#[7]	INTD#		INTD#	INTB#	INTA#

Table 6. MIDAS-20/50 Interrupt Routing

UNIVERSE INT.	PXB	PMC # 1	PMC # 2	PMC # 3	PMC # 4	PMC # 5
LINT#[0]						
LINT#[1]						
LINT#[2]						
LINT#[3]						
LINT#[4]	INTA#	INTB#	INTC#	INTA#	INTC#	INTB#
LINT#[5]	INTB#	INTC#	INTA#	INTB#	INTD#	INTC#
LINT#[6]	INTC#	INTA#	INTD#	INTC#	INTA#	INTD#
LINT#[7]	INTD#	INTD#	INTB#	INTD#	INTB#	INTA#

Table 7. MIDAS-20R/50R Interrupt Routing

Subtractive Decoding Agent

The CR/CSR PLD utilizes subtractive decoding in the PCI bus *I/O Space*. No other PCI devices are therefor allowed to do the same. Subtractive decoding in *Memory Space* may be used.

'Universe' Power-Up Options

A number of power-up options are loaded by the 'Universe' after power-up or system reset. A detailed description of these options is found in the UNIVERSE™ USER MANUAL. The table below shows how they are controlled on the MIDAS.

Option:	Enabled by	Register	Field	MIDAS-20
VME Register Access Slave Image	PWR/SYS	VRAI_CTL	EN	*VRAI jumper*
			VAS	*address size jumpers*
		VRAI_BS	BS	*Switch*
VME CR/CSR Slave Image	PWR/SYS	VCSR_CTL	LAS	I/O Space
		VCSR_TO	TO	'0x00'
		PCI_CSR	MAST_EN	*Enabled*
PCI Slave Image	PWR/SYS	LSI0_CTL	EN	Disabled
			LAS	Mem. space
			VAS	A16
		LSI0_BS	BS	0x0
		LSI0	BD	0x0
PCI Register Access	PWR/SYS	PCI_BS	SPACE	*I/O Space*
PCI Bus Size	RST#	MISC_STAT	LCLSIZE	32-bit
Auto-ID	PWR/SYS	MISC_STAT	DY4AUTO	*Disabled*
			VME64AUTO	*AUTO ID jumper*
BI-Mode	PWR/SYS	MISC_CTL	BI	Disabled
SYSFAIL* Assertion	PWR/SYS	VCSR_SET	SYSFAIL	*S FAIL jumper*
		VCSR_CLR	SYSFAIL	
Auto-Syscon Detect	SYS	MISC_CTL	SYSCON	*Enabled*

Table 8. 'Universe' Power-Up Options

Registers

The VME-PCI bridge on MIDAS is highly programmable through a large number of internal registers. In addition to this, MIDAS has one status register and a configuration ROM implemented in a PLD. All register & ROM locations on MIDAS can be accessed from VMEbus as well as from the PMC modules.

Note that parity is not generated when reading the MIDAS status register and configuration ROM. Parity errors should therefor be disregarded when reading these locations. In the power-up state of the Universe VME-PCI bridge, parity errors are disregarded.

Register Access from VMEbus

The MIDAS CR/CSR PLD is accessed using PCI bus I/O Space commands. From VMEbus this is done by accessing the CR/CSR address space of the board, or by using one of the four *VMEbus Slave Images* in the VME-PCI bridge. This image must be set up to generate I/O Space accesses on PCI bus.

Please refer to UNIVERSE™ USER MANUAL for details, and for information on how to access registers internal to the VME-PCI bridge.

Register Access from PCI Bus

The MIDAS CR/CSR PLD can be accessed directly from the PMC modules or the RACEway (through the PXB chip) by the use of the PCI bus I/O Space commands.

Register Descriptions

'Universe' Registers

Please refer to UNIVERSE™ USER MANUAL for this information.

'PXB' Registers

Please refer to PXB BRIDGE SPECIFICATION and Appendix IV for this information.

Configuration ROM

MIDAS Configuration ROM

CROM	**Offset: 03 (VME CR/CSR Space)**

Offset	ROM Value	Description
03		Checksum. Eight bit 2s complement binary checksum (CR bytes 03-7F).
07	00	Length of ROM to be checksummed. (MSB)
0B	00	Length of ROM to be checksummed. (NMSB)
0F	1F	Length of ROM to be checksummed. (LSB)
13	81	CR Data access width (0x81 = D08(EO), every forth byte)
17	81	CSR Data access width (0x81 = D08(EO), every forth byte)
1B	01	CR/CSR Space Specification ID (0x01 = VME64 - 1994 version)
1F	43	'C'. Used to identify valid CR.
23	52	'R'. Used to identify valid CR.
27	00	24 bit IEEE Assigned Manufacturers ID. 0x006046 = VMETRO
2B	60	
2F	46	
33	00	Board ID (VMETRO Assigned) 0x00100020 = MIDAS-20
37	10	
3B	00	
3F	20	
43	00	Revision ID (VMETRO Assigned) Example 0x0000C001 = PCB Rev: C, ECO-level:1
47	00	
4B	*PCB-rev.*	
4F	*ECO-level*	
53	00	Pointer to null terminated ASCII string. Revision ID (VMETRO Assigned) 0x000000 = No string
57	00	
5B	00	
5F-7B	00	Reserved for future use
7F	01	Program ID Code. 0x01 = No program, ID ROM only.

Table 9. MIDAS-20/20R and MIDAS-50/50R Configuration ROM

Appendix I:
MIDAS-20/50 PMC I/O Routing

The I/O connectors for PMC slots on the MIDAS-20R and the mother board of the MIDAS-50R are not mounted, and P2 rows A and C are used for the RACEway.

PMC2&4 J4	PMC1&3 J4	P2 row A
34	2	1
36	4	2
38	6	3
40	8	4
42	10	5
44	12	6
46	14	7
48	16	8
50	18	9
52	20	10
54	22	11
56	24	12
58	26	13
60	28	14
62	30	15
64	32	16
	34	17
	36	18
	38	19
	40	20
	42	21
	44	22
	46	23
	48	24
	50	25
	52	26
	54	27
	56	28
	58	29
	60	30
	62	31
	64	32

P2 row C	PMC1&3 J4	PMC2&4 J4
1	1	33
2	3	35
3	5	37
4	7	39
5	9	41
6	11	43
7	13	45
8	15	47
9	17	49
10	19	51
11	21	53
12	23	55
13	25	57
14	27	59
15	29	61
16	31	63
17	33	
18	35	
19	37	
20	39	
21	41	
22	43	
23	45	
24	47	
25	49	
26	51	
27	53	
28	55	
29	57	
30	59	
31	61	
32	63	

Appendix II:
MIDAS-20Z PMC I/O Routing

PMC1 J4	P2 A	P2 C	PMC1 J4
2	1	1	1
4	2	2	3
6	3	3	5
8	4	4	7
10	5	5	9
12	6	6	11
14	7	7	13
16	8	8	15
18	9	9	17
20	10	10	19
22	11	11	21
24	12	12	23
26	13	13	25
28	14	14	27
30	15	15	29
32	16	16	31
34	17	17	33
36	18	18	35
38	19	19	37
40	20	20	39
42	21	21	41
44	22	22	43
46	23	23	45
48	24	24	47
50	25	25	49
52	26	26	51
54	27	27	53
56	28	28	55
58	29	29	57
60	30	30	59
62	31	31	61
64	32	32	63

PMC2 J4	P2 Z	P2 D	PMC2 J4
2	1	1	1
	2	2	3
5	3	3	4
	4	4	6
8	5	5	7
	6	6	9
11	7	7	10
	8	8	12
14	9	9	13
	10	10	15
17	11	11	16
	12	12	18
20	13	13	19
	14	14	21
23	15	15	22
	16	16	24
26	17	17	25
	18	18	27
29	19	19	28
	20	20	30
32	21	21	31
	22	22	33
35	23	23	34
	24	24	36
38	25	25	37
	26	26	39
41	27	27	40
	28	28	42
44	29	29	43
	30	30	45
46	31	31	
	32	32	

Appendix III:
Universe Configuration Examples

General Information

Note that the 'Universe' PCI-VME Bridge, performs byte swapping of the data lanes on all transactions between VMEbus and PCI bus. This is also the case for accesses to the internal registers. The internal register bank is located on the 'PCI side' of the byte swapping. This means that when registers are read or written from the VMEbus, all bytes are shuffled (compared to the bit numbering used in the Universe User Manual).

VMEbus Slave Images

PCI Master Enable

In addition to the configuration registers for the VMEbus slave images, one control register bit is essential for mapping VMEbus cycles to PCI bus cycles through the Universe; the PCI master enable ('BM') bit located in the PCI_CSR register space (offset: 0x004). This bit is set as a default after power up.

Some VMEbus Slave Image examples are shown bellow:

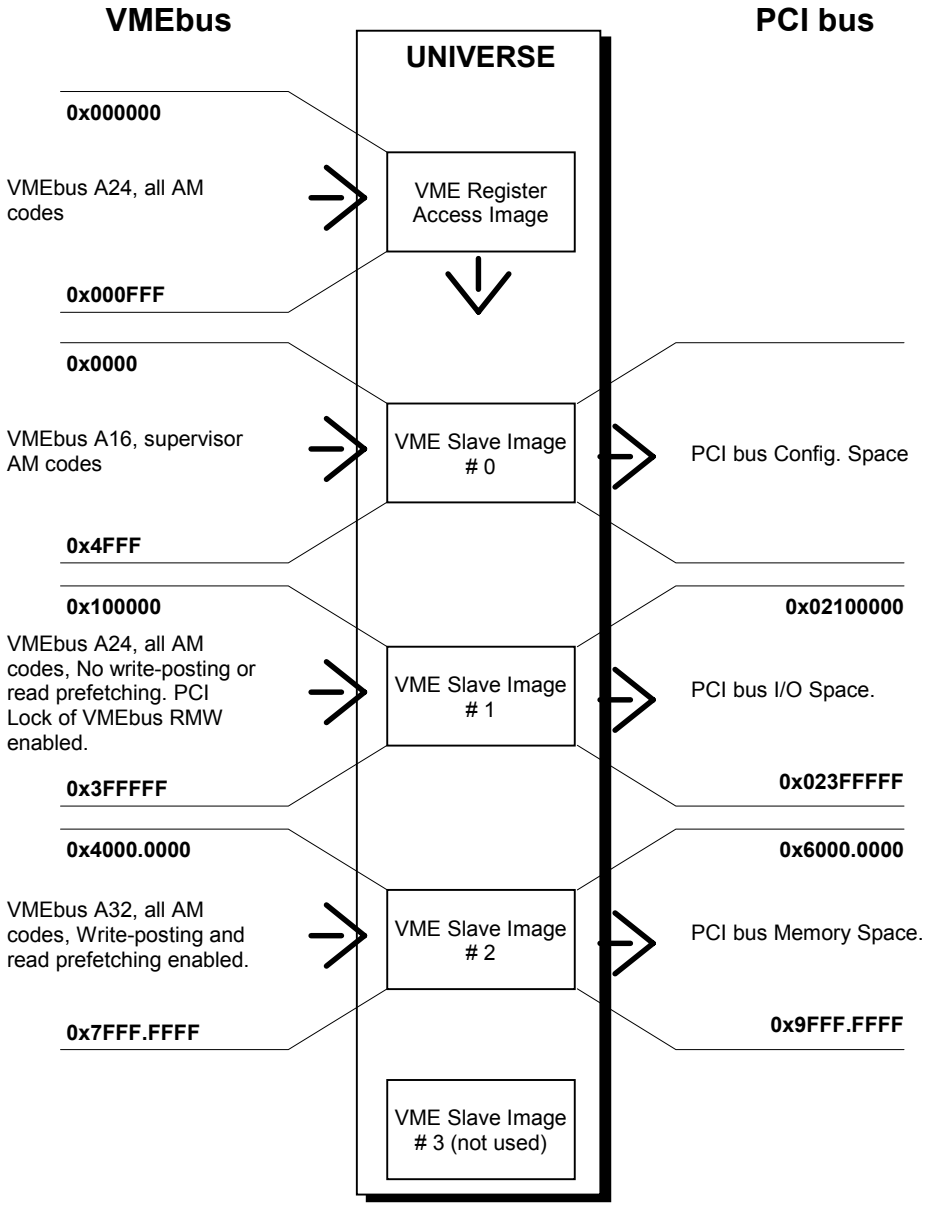


Figure 9. Configuration Example for VMEbus Slave Images

VMEbus Register Access Image

In this configuration example, the VMEbus Register Access Image is set up by use of the DIP switch and jumpers.

Action:	Result:
Locate *VRAI* in its upper position.	*VME_RAI is enabled.*
Locate both of the address size jumpers in their upper positions.	*VME_RAI is mapped in A24 address space.*
Set the DIP switch with all switches pointing down.	*VME_RAI base address is set to 0x000000.*
Locate the *Auto ID jumper* in its lower position.	*Disable Auto-slot ID protocol.*

Table 10. VME_RAI Setup.

With the jumper settings described above, the Universe will power up in a state where VMEbus accesses with A24 AM codes, in the address range 0x0-0xFFF, will map into Universe registers.

The VME_RAI will be utilized to set up the VMEbus slave images described below.

VMEbus Slave Image 0

In this configuration example, the VMEbus Slave Image 0 is set up to map A16 supervisory accesses, in the address range 0x0-0x4FFF, from VMEbus to Configuration Cycles on the PCI bus.

Write from VME	PCI Data [1)]	Result:
D:0x0000.0000 to A:0x000F04	0x0000.0000	*Base Address set to 0x000000*
D:0x0050.0000 to A:0x000F08	0x0000.5000	*Bound Address set to 0x005000*
D:0x0000.0000 to A:0x000F0C	0x0000.0000	*Translation Offset set to 0x000000*
D:0x0200.E080 to A:0x000F00	0x80E0.0002	*Enable Image, VAS=A16, LAS=Config Space, PGM=both, SUPER=Supervisor, other options disabled.*

[1)] This column shows write data for configuration from PCI

Table 11. VME Slave Image 0 - Setup

VMEbus Slave Image 1

The VMEbus Slave Image 1 is set up to map A24 accesses, in the address range 0x100000-0x3FFFFF from VMEbus to I/O Cycles on the PCI bus, with PCI addresses starting from 0x02100000.

Write from VME	PCI Data [1)]	Result:
D:0x0000.1000 to A:0x000F18	0x0010.0000	*Base Address set to 0x100000*
D:0x0000.4000 to A:0x000F1C	0x0040.0000	*Bound Address set to 0x400000*
D:0x0000.0002 to A:0x000F20	0x0200.0000	*Translation Offset set to 0x2000000*
D:0x4100.F180 to A:0x000F14	0x80F1.0041	*Enable Image, VAS=A24, LAS=I/O Space, PGM=both, SUPER=both, LLRMW=enabled, other options disabled.*

Table 12. VME Slave Image 1 - Setup.

[1)] This column shows write data for configuration from PCI

VMEbus Slave Image 2

VMEbus Slave Image 2 is set up to map A32 accesses, in the address range 0x4000.0000-0x7FFF.FFFF, from VMEbus to Memory Cycles on the PCI bus, with PCI addresses starting from 0x6000.0000. Write posting and read prefetching is enabled.

Write from VME	PCI Data [1)]	Result:
D:0x0000.0040 to A:0x000F2C	0x4000.0000	*Base Address set to 0x4000.0000*
D:0x0000.0080 to A:0x000F30	0x8000.0000	*Bound Address set to 0x8000.0000*
D:0x0000.0020 to A:0x000F34	0x2000.0000	*Translation Offset set to 0x2000.0000*
D:0x0000.F2E0 to A:0x000F28	0xE0F2.0000	*Enable Image, VAS=A32, LAS=Mem. Space, PGM=both, SUPER=both, PWEN&PREN= enabled, other options disabled.*

[1)] This column shows write data for configuration from PCI

Table 13. VME Slave Image 2 - Setup.

Initialization Sequence

By performing the list of cycles shown in the table below, the mapping for this configuration example is achieved.

Write from VME	PCI Data [1)]	Result:
D:0x0000.0000 to A:0x000F04	0x0000.0000	*VSI_0: Base Address set to 0x000000*
D:0x0050.0000 to A:0x000F08	0x0000.5000	*VSI_0: Bound Address set to 0x005000*
D:0x0000.0000 to A:0x000F0C	0x0000.0000	*VSI_0: Translation Offset set to 0x000000*
D:0x0200.E080 to A:0x000F00	0x80E0.0002	*VSI_0: Enable Image, VAS=A16, LAS=Config Space, PGM=both, SUPER=Supervisor, other options disabled.*
D:0x0000.1000 to A:0x000F18	0x0010.0000	*VSI_1: Base Address set to 0x100000*
D:0x0000.4000 to A:0x000F1C	0x0040.0000	*VSI_1: Bound Address set to 0x400000*
D:0x0000.0002 to A:0x000F20	0x0200.0000	*VSI_1: Translation Offset set to 0x2000000*
D:0x4100.F180 to A:0x000F14	0x80F1.0041	*VSI_1: Enable Image, VAS=A24, LAS=I/O Space, PGM=both, SUPER=both, LLRMW=enabled, other options disabled.*
D:0x0000.0040 to A:0x000F2C	0x4000.0000	*VSI_2: Base Address set to 0x4000.0000*
D:0x0000.0080 to A:0x000F30	0x8000.0000	*VSI_2: Bound Address set to 0x8000.0000*
D:0x0000.0020 to A:0x000F34	0x2000.0000	*VSI_2: Translation Offset set to 0x2000.0000*
D:0x0000.F2E0 to A:0x000F28	0xE0F2.0000	*VSI_2: Enable Image, VAS=A32, LAS=Mem. Space, PGM=both, SUPER=both, PWEN&PREN= enabled, other options disabled.*

[1)] This column shows write data for configuration from PCI

Table 14. Initialization Sequence for VMEbus Slave Image Config. Example.

PCI Slave Images

The VME_RAI, described in the 'VMEbus Slave Image' section, is also utilized to set up PCI slave images in the examples below.

PCI Target Enable - Memory & I/O Space

In addition to the configuration registers for the PCI slave images, two control register bits are essential for mapping PCI bus cycles to VMEbus cycles through the Universe. The PCI Target Memory Enable ('MS') and Target IO Enable ('IOS') bits, located in the PCI_CSR register (offset: 0x004), must be set to allow the Universe to respond to PCI memory and I/O commands.

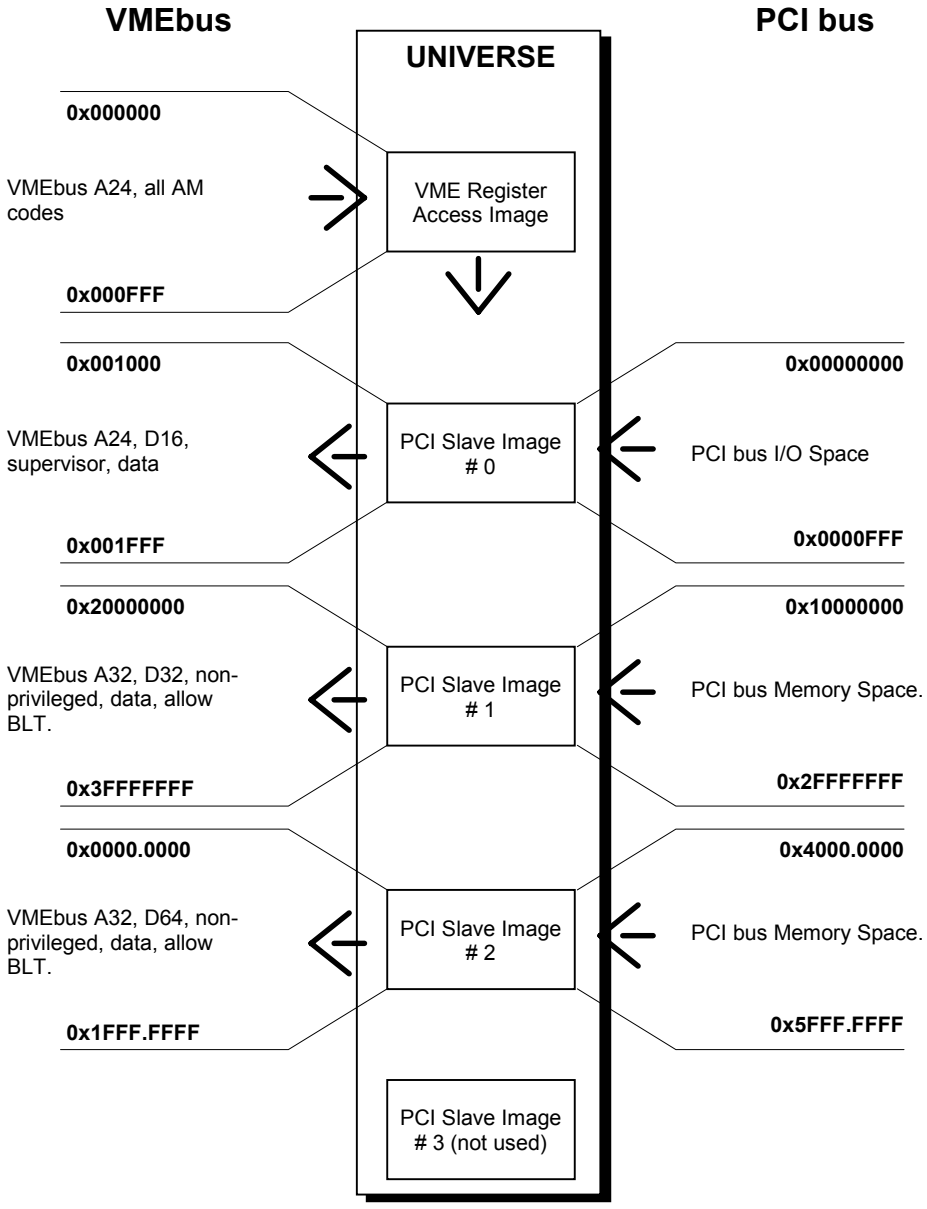


Figure 10. Configuration Example for PCI Slave Images

PCI Slave Image 0

In this configuration example, the PCI Slave Image 0 is set up to map PCI I/O Space transactions, in the address range 0x0-0xFFF, to A24, D16 VMEbus cycles, in the address range 0x1000-0x1FFF.

Write from VME	PCI Data [1)]	Result:
D:0x0000.0000 to A:0x000104	0x0000.0000	*Base Address set to 0x0000.0000*
D:0x0010.0000 to A:0x000108	0x0000.1000	*Bound Address set to 0x0000.1000*
D:0x0010.0000 to A:0x00010C	0x0000.1000	*Translation Offset set to 0x0000.1000*
D:0x0110.4180 to A:0x000100	0x8041.1001	*Enable Image, VAS=A24, VDW=D16, LAS=I/O Space, PGM=data, SUPER=supervisor, other options disabled.*

[1)] This column shows write data for configuration from PCI

Table 15. PCI Slave Image 0 Setup.

PCI Slave Image 1

In this configuration example, the PCI Slave Image 1 is set up to map PCI Memory Space transactions, in the address range 0x1000.0000-0x2FFF.FFFF, to A32, D32 VMEbus cycles, in the address range 0x2000.0000-0x3FFF.FFFF.

Write from VME	PCI Data [1)]	Result:
D:0x0000.0010 to A:0x000118	0x1000.0000	*Base Address set to 0x1000.0000*
D:0x0000.0030 to A:0x00011C	0x3000.0000	*Bound Address set to 0x3000.0000*
D:0x0000.0010 to A:0x000120	0x1000.0000	*Translation Offset set to 0x1000.0000*
D:0x0001.82C0 to A:0x000114	0xC082.0100	*Enable Image, VAS=A32, VDW=D32, LAS=Mem. Space, PGM=data, SUPER=non-priv, Posted Write enabled, BLT allowed.*

[1)] This column shows write data for configuration from PCI

Table 16. PCI Slave Image 1 Setup.

PCI Slave Image 2

PCI Slave Image 2 is set up to map PCI Memory Space transactions, in the address range 0x4000.0000-0x5FFF.FFFF to A32, D64 VMEbus cycles, in the address range 0x0000.0000-0x1FFF.FFFF.

Write from VME	PCI Data [1)]	Result:
D:0x0000.0040 to A:0x00012C	0x4000.0000	*Base Address set to 0x4000.0000*
D:0x0000.0060 to A:0x000130	0x6000.0000	*Bound Address set to 0x6000.0000*
D:0x0000.00C0 to A:0x000134	0xC000.0000	*Translation Offset set to 0xC000.0000*
D:0x0001.C2C0 to A:0x000128	0xC0C2.0100	*Enable Image, VAS=A32, VDW=D64, LAS=Mem. Space, PGM=data, SUPER=non-priv, Posted Write enabled, BLT allowed.*

[1)] This column shows write data for configuration from PCI

Table 17. PCI Slave Image 2 Setup.

Initialization Sequence

By performing the list of cycles shown in the table below, the mapping for this configuration example is achieved.

Write from VME	PCI Data [1)]	Result:
D:0x0700.8002 to A:0x000004	0x0200.0007	*PCI Target Enable bits set. (this write cycle also sets the PCI master enable bit if it is disabled, ref. VMEbus Slave Image section).*
D:0x0000.0000 to A:0x000104	0x0000.0000	*LSI_0: Base Address set to 0x0000.0000*
D:0x0010.0000 to A:0x000108	0x0000.1000	*LSI_0: Bound Address set to 0x0000.1000*
D:0x0010.0000 to A:0x00010C	0x0000.1000	*LSI_0: Translation Offset set to 0x0000.1000*
D:0x0110.4180 to A:0x000100	0x8041.1001	*LSI_0: Enable Image, VAS=A24, VDW=D16, LAS=I/O Space, PGM=data, SUPER=supervisor, other options disabled.*
D:0x0000.0010 to A:0x000118	0x1000.0000	*LSI_1: Base Address set to 0x1000.0000*
D:0x0000.0030 to A:0x00011C	0x3000.0000	*LSI_1: Bound Address set to 0x3000.0000*
D:0x0000.0010 to A:0x000120	0x1000.0000	*LSI_1: Translation Offset set to 0x1000.0000*
D:0x0001.82C0 to A:0x000114	0xC082.0100	*LSI_1: Enable Image, VAS=A32, VDW=D32, LAS=Mem. Space, PGM=data, SUPER=non-priv, Posted Write enabled, BLT allowed.*
D:0x0000.0040 to A:0x00012C	0x4000.0000	*LSI_2: Base Address set to 0x4000.0000*
D:0x0000.0060 to A:0x000130	0x6000.0000	*LSI_2: Bound Address set to 0x6000.0000*
D:0x0000.00C0 to A:0x000134	0xC000.0000	*LSI_2: Translation Offset set to 0xC000.0000*
D:0x0001.C2C0 to A:0x000128	0xC0C2.0100	*LSI_2: Enable Image, VAS=A32, VDW=D64, LAS=Mem. Space, PGM=data, SUPER=non-priv, Posted Write enabled, BLT allowed.*

[1)] This column shows write data for configuration from PCI

Table 18. Initialization Sequence for PCI Slave Image Config. Example.

Appendix IV: INTEL 21152 Configuration Example

The PCI-to-PCI bridge on the MIDAS-50/50R board is set up by use of PCI configuration cycles. A slightly different setup of the VMEbus Slave Images in the Universe is used compared to previous configuration examples.

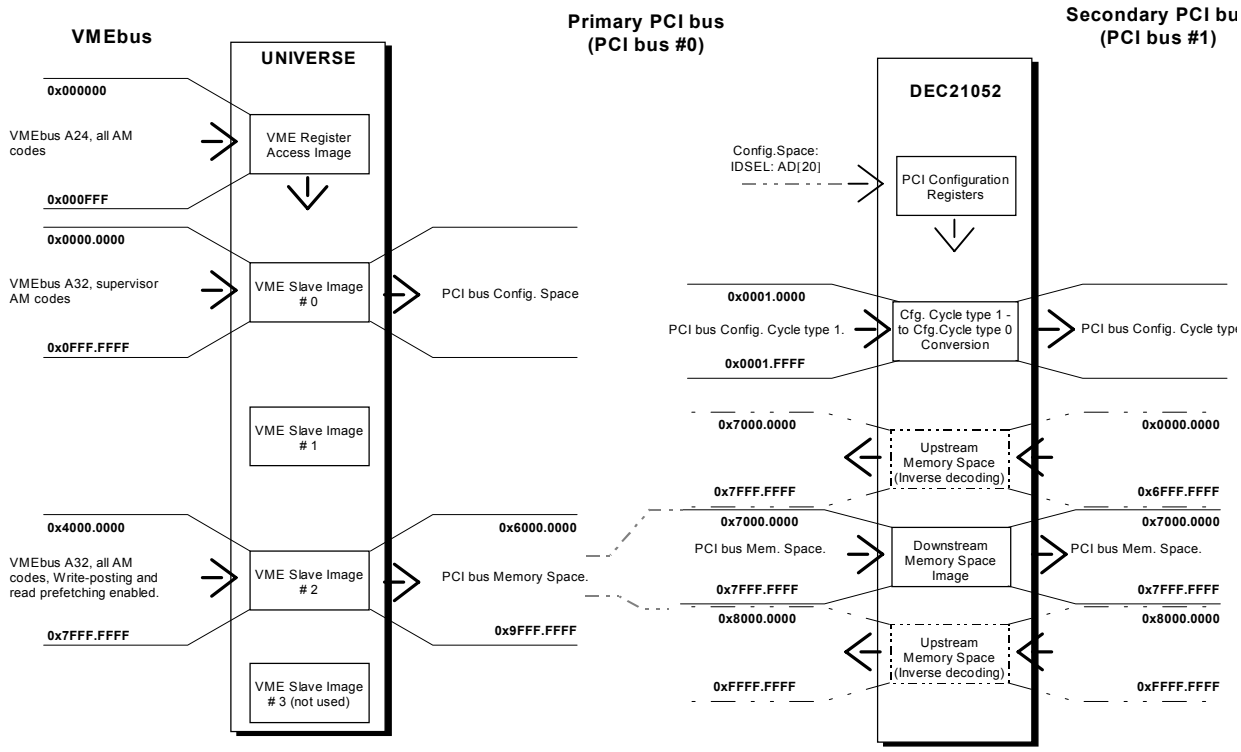


Figure 11. Configuration Examples for the PCI-to-PCI Bridge

Universe Initialization Sequence

By performing the list of cycles shown in the table below, the Universe is set up according to the address mapping for this configuration example.

Write from VME	PCI Data [1)]	Result:
D:0x0700.8002 to A:0x000004	0x0280.0007	*PCI Master Enable bit set. (this write cycle also sets the PCI target enable bit).*
D:0x0000.0000 to A:0x000F04	0x0000.0000	*VSI_0: Base Address set to 0x0000.0000*
D:0x0000.0010 to A:0x000F08	0x1000.0000	*VSI_0: Bound Address set to 0x0000.0010*
D:0x0000.0000 to A:0x000F0C	0x0000.0000	*VSI_0: Translation Offset set to 0x0000.0000*
D:0x0200.E280 to A:0x000F00	0x80E2.0002	*VSI_0: Enable Image, VAS=A32, LAS=Config Space, PGM=both, SUPER=Supervisor, other options disabled.*
D:0x0000.F000 to A:0x000F14	0x00F0.0000	*VSI_1: Image disabled*
D:0x0000.0040 to A:0x000F2C	0x4000.0000	*VSI_2: Base Address set to 0x4000.0000*
D:0x0000.0080 to A:0x000F30	0x8000.0000	*VSI_2: Bound Address set to 0x8000.0000*
D:0x0000.0020 to A:0x000F34	0x2000.0000	*VSI_2: Translation Offset set to 0x2000.0000*
D:0x0000.F2E0 to A:0x000F28	0xE0F2.0000	*VSI_2: Enable Image, VAS=A32, LAS=Mem. Space, PGM=both, SUPER=both, PWEN&PREN= enabled, other options disabled.*

[1)] This column shows write data for configuration from PCI

Table 19. Initialization Sequence for Universe.

Intel 21152 Configuration Sequence

Some basic configuration registers of the PCI-to-PCI bridge chip must be set up prior to operation of the bridge.

In this configuration example the primary PCI bus is defined as bus#0, and the secondary bus as bus#1.

Write from VME	PCI Cycle [1)]	Result:
D:0x0700.8002 to A:0x0000.4804, AM=0D	D:0x0280.0007 to Cfg.Space A:0x0000.4804	*Intel 21152 Enable PCI Target I/O- and Memory space, and Master enable.*
D:0x0001.0100 to A:0x0000.4818, AM=0D	D:0x0001.0100 to Cfg.Space A:0x0000.4818	*Secondary bus number: 1.* *Highest downstream bus number:1*
D:0x0070.F07F to A:0x0000.4820, AM=0D	D:0x7FF0.7000 to Cfg.Space A:0x0000.4818	*Downstream address window:* *0x7000.0000 - 0x7FFF.FFFF.*

1) This column shows the PCI bus command resulting from the VMEbus access. Configuration can also be done directly from PCI bus.

Table 20. Intel 21152 Initialization Sequence.

After the initialization sequence described in the sections above, one 256Mbyte window into the memory space of the secondary PCI bus is set up.

VME Address	Primary PCI Address	Secondary PCI Address

A32: 0x5000.0000-0x5FFF.FFFF	Mem: 0x7000.0000 - 0x7FFF.FFFF	Mem: 0x7000.0000 - 0x7FFF.FFFF

Table 21. Address map resulting from this configuration example.

Scan PCI Config. Space on MIDAS-50/50R

Using VMEbus Slave Image set up and the Intel 21152 set up in this configuration example, a VMEbus host can scan the configuration space on the MIDAS-50/50R board by performing the set of read cycles listed below.

Read from VME host	**Primary PCI**	**Result:**
AM=0x0D, A:0x0000.2800	0x0001.0000	Read Device-ID / Vendor-ID from PMC module installed in PMC slot#1
AM=0x0D, A:0x0000.3000	0x0002.0000	Read Device-ID / Vendor-ID from PMC module installed in PMC slot#2
AM=0x0D, A:0x0000.4800	0x0010.0000	Read (Byte-swapped Device-ID / Vendor-ID from PCI-to-PCI bridge).
AM=0x0D, A:0x0001.0000	*type 1*	Read Device-ID / Vendor-ID from PMC module installed in PMC slot#3
AM=0x0D, A:0x0001.0800	*type 1*	Read Device-ID / Vendor-ID from PMC module installed in PMC slot#4
AM=0x0D, A:0x0001.1000	*type 1*	Read Device-ID / Vendor-ID from PMC module installed in PMC slot#5

Table 22. Scanning PCI Config.Space on MIDAS-50/50R

Appendix V:
PXB Information

PXB PCI-RACEway Bridge

The PXB is a high performance RACEway to PCI bridge developed by Mercury Computer Systems. It features:

- Bridges a 32 bit, 33MHz PCI bus with a 32 bit, 40MHz RACEway switching fabric.
- Compliant to Rev 2.1 PCI local bus specification, including delayed operations.
- Compliant to Rev 1.0 PCI to PCI Bridge specification.
- Bridges up to sixteen 32 bit, 33MHz PCI busses
- Able to sustain up to 125MB/sec with large memory write transfers, and 100MB/sec with large memory read transfers.
- Integral FIFOs for write posting to maximize bandwidth utilization.

PXB Register Descriptions

P-Side Register Descriptions

If no valid PROM is present, the PXB powers up in 'endpoint mode', but should always be used in bridge mode. This is done by clearing bit 6 in register +0x40.

Configuration Space Registers				Offset
Device ID *(PXB=0001)*		Vendor ID *(MC=1134)*		00
Status *(0480=default)*		Command		04
Class Code *(060000)*			Revision *(00)*	08
00	Header *(01)*	Latency	Cache	0C
Prefetchable Memory BAR *(Endpoint Mode Only)*				10
Memory Mapped I/O BAR *(internal registers)*				14
Sec Latency	Sub Bus#	Sec Bus#	Pri Bus#	18
Secondary Status		I/O Limit	I/O Base	1C
Memory Mapped I/O Limit		Memory Mapped I/O Base		20
Pref. Memory Limit		Pref. Memory Base		24
0000.0000				28
0000.0000				2C
I/O Limit (upper 16)		I/O Base (upper 16)		30
0000.0000				34
EEPROM Address Register		*0000*		38
Bridge Control		Int. Pin	Int. Line	3C
PXB Misc.	IO/MIO Shift	Memory Window	PXB Bridge Control	40
Memory Internal Base				44
Misc. BAR Size				48
				4C
Mailbox Vector				50
Memory Mask				54
I/O Mask				58
MI/O Mask				5C
Subsystem Vendor Information				60
PCI Miscon				64
Arbitration Control				68
				6C
EEPROM Data Register				70

Table 23. PXB P-side CSR Registers

'PCI Command Register'

Register Name: PCMDR	Size: 16 bits	Offset: 0x04

Bits	Function							
15:8	*RESERVED (000000).*						*0*	SERR_EN
7:0	*0*	PERR_EN	*0*	*0*	*0*	BM	MS	IOS

PCMDR Description

Name	Type	Reset State	Function
SERR_EN	R/W	0	SERR Enable
PERR_EN	R/W	0	PERR Generation enable
BM	R/W	1	PCI Master Enable
MS	R/W	1	Memory Space Target Enable
IOS	R/W	1	I/O Space Target Enable

Table 24. PCI Command Register

'PCI Status Register'

Register Name: PSR	Size: 16 bits	Offset: 0x06

Bits	Function						
15:8	DPE	SSE	RMAB	RTAB	STAB	DEVSEL	DPD
7:0	*RESERVED (000000).*						

PSR Description

Name	Type	Reset State	Function
DPE	R/W		Detected parity error
SSE	R/W		Signaled SERR
RMAB	R/W		Received Master Abort
RTAB	R/W		Received Target Abort
STAB	R	0	Signaled Target Abort. Always 0.
DEVSEL	R	10	DEVSEL Timing. 10=slow.
DPD	R/W	0	Data Parity Detected.

Table 25. PCI Status Register

'Secondary Status Register'

Register Name: SSR	Size: 16 bits	Offset: 0x1E

Bits	Function						
15:8	DPE	RSE	RMAB	RTAB	STAB	DEVSEL	DPD
7:0	*RESERVED (000000).*						

SSR Description

Name	Type	Reset State	Function
DPE	R/W		Detected parity error
RSE	R/W		Received SERR
RMAB	R/W		Received Master Abort
RTAB	R/W		Received Target Abort
STAB	R	0	Signaled Target Abort. Always 0.
DEVSEL	R	10	DEVSEL Timing. 10=slow.
DPD	R/W	0	Data Parity Detected.

Table 26. Secondary Status Register

'Memory Mapped I/O Base Address Register'

Register Name: MIOBAR	Size: 16 bits	Offset: 0x20

Bits	Function	
15:8	MIOBA(31:24)	
7:0	MIOBA(23:16)	*0000*

MIOBAR Description

Name	Type	Reset State	Function
MIOBA	R/W		Base Address (inclusive) for Memory Mapped I/O (20 lsb assumed 0). Alignment 1MB.

Table 27. Memory Mapped I/O Base Address Register

'Memory Mapped I/O Limit Address Register'

Register Name: MIOLAR	Size: 16 bits	Offset: 0x22

Bits	Function	
15:8	MIOLA(31:24)	
7:0	MIOLA(23:16)	*0000*

MIOLAR Description

Name	Type	Reset State	Function
MIOLA	R/W		Base Limit (inclusive) for Memory Mapped I/O (20 lsb assumed 1). Alignment 1MB.

Table 28. Memory Mapped I/O Limit Address Register

'Prefetchable Memory Base Address Register'

Register Name: PMBAR	Size: 16 bits	Offset: 0x24

Bits	Function	
15:8	PMBA(31:24)	
7:0	PMBA(23:16)	*0000*

PMBAR Description

Name	Type	Reset State	Function
PMBA	R/W		Base Address (inclusive) for Prefetchable Memory space (20 lsb assumed 0). Alignment 1MB.

Table 29. Prefetchable Memory Base Address Register

'Prefetchable Memory Limit Address Register'

Register Name: PMLAR	Size: 16 bits	Offset: 0x26

Bits	Function	
15:8	PMLA(31:24)	
7:0	PMLA(23:16)	*0000*

PMLAR Description

Name	Type	Reset State	Function
PMLA	R/W		Base Limit (inclusive) for PrefetchableMemory space (20 lsb assumed 1). Alignment 1MB.

Table 30. Prefetchable Memory Limit Address Register

'Bridge Control Register'

Register Name: BCR	Size: 16 bits	Offset: 0x3E

Bits	Function							
15:8	*RESERVED (0000.0000).*							
7:0	FBTB	SBRES	MAM		VGAEN	ISAEN	SERREN	PERREN

BCR Description

Name	Type	Reset State	Function
FBTB	R/W	0	Fast Back to Back Enable
SBRES	R/W	0	Secondary Bus Reset. 0 = Do not assert RST 1 = Assert RST on secondary bus
MAM	R/W		Master Abort Mode. 0= Do not report master abort (all 1) 1= Report master abort with target abort.
VGAEN	R/W	0	VGA Enable
ISAEN	R/W	0	ISA Enable.
SERREN	R/W	0	Enable for system errors detected on secondary bus and reported to primary bus.
PERREN	R/W	0	Enable for parity errors response on secondary bus.

Table 31. Bridge Control Register

'PXB Bridge Control Register'

Register Name: PBCR	Size: 8 bits	Offset: 0x40

Bits	Function							
7:0	EIBAR	MODE	WSWAP	BSWAP	*0*	PRIM	RPRIM	EPBAR

PBCR Description

Name	Type	Reset State	Function
EIBAR	R/W		Enable memory internal BAR. (1=enable, 0=disable)
MODE	R/W		Operating Mode. 0 = Bridge Mode 1 = Endpoint Mode *This bit should always be cleared (use Bridge Mode !).*
WSWAP	R/W	1	Word Swap (1=enable, 0=disable)
BSWAP	R/W	0	Byte Swap (1=enable, 0=disable)
PRIM	R/W		Prim/Sec Mode 0= Secondary Mode 1 = Primary Mode
RPRIM	R		Same as above, read
EPBAR	R/W		Enable prefetchable memory BAR. (1=enable, 0=disable)

Table 32. PXB Bridge Control Register

'Memory Window Register'

Register Name: MWR	Size: 8 bits	Offset: 0x41

Bits	Function	
7:0	PPAGE	MWSHIFT

MWR Description

Name	Type	Reset State	Function
PPAGE	W		Primary Page. Used by secondary PXB as index into page ram when out-of-bounds accesses occurs; should be set to unused page register. Returns zeros when read.
MWSHIFT	R/W		Memory window shift. Selects which address bitsare used to index page ram during memory accesses. Bits "Big Window" "Small Window" 0000 31:28 4GB 256 MB 0001 30:27 2 GB 128 MB 0010 29:26 1 GB 64 MB 0011 28:25 512 MB 32 MB 0100 27:24 256 MB 16 MB 0101 26:23 128 MB 8 MB 0110 25:22 64 MB 4 MB 0111 24:21 32 MB 2 MB 1xxx 23:20 16 MB 1 MB

Table 33. Memory Window Register

'IO/MIO Window Register'

Register Name: IOMIOWR	Size: 8 bits	Offset: 0x42

Bits	Function	
7:0	IOSHIFT	MIOSHIFT

MWR Description

Name	Type	Reset State	Function
IOSHIFT	R/W		I/O window shift. Selects which address bits are used to index page ram during I/O accesses. Bits — "Big Window" — "Small Window" 0000 23:20 16 MB 1 MB 0001 22:19 8 MB 512 KB 0010 21:18 4 MB 256 KB 0011 20:17 2 MB 128 KB 0100 19:16 1 MB 64 KB 0101 18:15 512 KB 32 KB 0110 17:14 256 KB 16 KB 0111 16:13 128 KB 8 KB 1xxx 15:12 64 KB 4 KB
MIOSHIFT	R/W		Memory Mapped I/O window shift. Selects which address bits are used to index page ram during memory mapped I/O accesses. Bits — "Big Window" — "Small Window" 0000 29:26 1 GB 64 MB 0001 28:25 512 MB 32 MB 0010 27:24 256 MB 16 MB 0011 26:23 128 MB 8 MB 0100 25:22 64 MB 4 MB 0101 24:21 32 MB 2 MB 0110 23:20 16 MB 1 MB 0111 22:19 8 MB 512 KB 1xxx 21:18 4 MB 256 KB

Table 34. IO/MIO Window Register

'PXB Misc. Register'

Register Name: PMR	Size: 8 bits	Offset: 0x43

Bits	Function				
7:0			UNAL	NAL	PPAGE

PMR Description

Name	Type	Reset State	Function
UNAL	R/W	0	Unaligned (1=unaligned, 0=aligned). *For most normal operations "aligned" operation is used.*
NAL	R/W		No auto load. Used to control if the PCI mask registers are auto loaded for each RACEway-to-PCI transaction. *Should always be 0 for secondary PXBs.*
PPAGE	R		Primary Page. Read only.

Table 35. PXB Misc. Register

X-Side Register Descriptions

X-side Internal Registers	Offset
MailBox Write	400
Generate/Clear Interrupts	408
MISCON	410
Force Test Increment (test only)	418
Interrupt Mask Load/ Status Read	420
Unused	428
Unused	430
Load RTC/Performance #1&#2 From Modulus	438
Load RTC/Performance #1 Modulus	440
Load RTC/Performance #1 From Modulus / Read RTC/Performance #1	448
Load RTC/Performance #2 Modulus	450
Load RTC/Performance From Modulus / Read RTC/Performance #2	458
Load Free Running Counter	460
Write Mailbox Base Address	470
DMA Remote Address (diagnostics)	478
DMA Nest Pointer	480
DMA Local Address (diagnostics)	488
DMA Word Count (diagnostics)	490
DMA Link Address (diagnostics)	498
DMA Last Pointer (diagnostics)	4A0
Clear Remote Bus Error Interrupt	4B0
Clear RTC-1 Interrupt	4E8
Clear RTC-2 Interrupt	4F0
Clear Mailbox Interrupt (primary side)	4F8
Route for Page - 0	504
Return Route for Page - 0	50C
Route for Page - 1	514
Return Route for Page - 1	51C
Route for Page - 2	524
Return Route for Page - 2	52C
Route for Page - 3	534
Return Route for Page - 3	53C
Route for Page - 4	544
Return Route for Page - 4	54C
Route for Page - 5	554
Return Route for Page - 5	55C
Route for Page - 6	564
Return Route for Page - 6	56C
Route for Page - 7	574

Return Route for Page - 7	57C
Route for Page - 8	584
Return Route for Page - 8	58C
Route for Page - 9	594
Return Route for Page - 9	59C
Route for Page - 10	5A4
Return Route for Page - 10	5AC
Route for Page - 11	5B4
Return Route for Page - 11	5BC
Route for Page - 12	5C4
Return Route for Page - 12	5CC
Route for Page - 13	5D4
Return Route for Page - 13	5DC
Route for Page - 14	5E4
Return Route for Page - 14	5EC
Route for Page - 15	5F4
Return Route for Page - 15	5FC

Table 36. PXB X-side CSR Registers

Miscellaneous PXB Information

Configuration Serial EEPROM

- In typical P2P applications the configuration PROM is normally used only by the primary PXB. Secondary PXBs are set up from the host using config. cycles type 1, through the primary PXB.
- In an embedded application using a fixed predetermined address map, where no 'off-the-shelf' POST initialization code is running, all PXBs may be initialized almost completely from the configuration PROM. The only bit field which must be set is the 'Routes_to_Primary' bit, in the Miscon register (+0x410).
- All configuration registers inside the PXB may be initialized from either side of the chip.
- In order for a primary PXB to do Type1-to-Type0 configuration operations, or virtual Type1-to-Type0 operations (accessing CSRs in secondary PXBs), the lookup tables for config.ops. in the PROM must be initialized. The contents of these tables are used to index the route table for configuration type 1 accesses. The tables are located in PROM address ranges 0x80-0xBF, and 0x220-→.

PCI-to-RACEway Addressing

- Three bits of PCI address are used to index the Route Table. This table holds the routes used to set up a connection through the crossbars.

- With Big Mem enabled, the least significant portion of the Return Route holds the most significant bits of the RACEway address. Bit 0 of the Return Route will replace the least significant PCI bus address bit used to index the Route Table. The most significant bit replaced is always bit 27 of the PCI address. Big Mem is only used for prefetchable memory space. **Big Mem is not used for P2P applications.**

Configuration Cycles

- Lookup table, in EEPROM, is used to index the route table for each PCI bus device.

PXB Route Format

Bits	Function				
31:24	Routes				
23:16	Routes				
15:8	Routes				
7:0		BigMem	Not Splitable	Priority	B'cast

PXB Route Description

Name	Function
Routes	Concatenated three-bit route codes, one per crossbar hop. Route codes: 111 = Port A, 110 = Port B, 101 = Port C, 100 = Port D 011 = Port E, 010 = Port F, 001 = Adaptive Route (E first), 000 = Adaptive Route (F first). *Example: Route entry: 0xFACx.xxxA is used to route a transfer through 4 crossbars, ports A, B, C, and D, with splitable bit set, and priority 01.*
BigMem	Enables addition of high order address bits when addressing RACEway from PCI. **Not to be used for P2P operation.**
Split Disable	A 1 disables split transactions on RACEway. **Split should always be enabled.**
Priority	Two bit priority code. Ref. RACEway specification. Note: Never use 11b as priority for I/O space.
Broadcast	Set for broadcast operations on RACEway. In broadcast mode the meaning of rout codes change. Ref. RACEway specification. Requires split disabled and no BigMem.

Table 37. PXB Route Format

PXB Return Route Format

Bits	Function
31:24	Return Routes
15:8	Return Routes

15:8	Return Routes
7:0	Big Address

PXB Return Route Description

Name	Function
Return Routes	Concatenated three-bit route codes used in the response of split RACEway transactions, one three-bit field per hop. Return Route codes: 111 = Port A, 110 = Port B, 101 = Port C, 100 = Port D 011 = Port E, 010 = Port F, 001 = Adaptive Route (E first), 000 = Adaptive Route (F first). **If 'Split Disable' in the route is set, the return route is not used.**
BigAddress	In BigMem Mode a number of bits (number is depending on prefetchable memory window size) from this field replaces the most significant address bits when going from PCI into RACEway. Bit 0 of this field replaces the least significant bit used to index the page table. The most significant bit replaced is always bit 27 of the PCI address. With 256MByte windows no bits are replaced. **If BigMem Mode is not used (always the case for P2P applications), this field is not used.**

Table 38. PXB Return Route Format

RACEway-to-PCI Addressing

- PCI Mask registers (one for each address window) are always used by secondary PXB to generate the high-order PCI address bits. All bits from the least significant '1' and up to 3 are used as PCI bus addresses. These registers are normally loaded automatically from the BARs for each transaction (i.e. as long as the no-autoload bit in register +0x40 is cleared). **The register is not used by primary PXB.**

PCI-to-PCI Bridge Operation

- Both a memory mapped I/O window and a prefetchable memory window must be defined in order to make the bridge operation from secondary to primary side work correctly.
- BAR and limit registers of the secondary PXB are set to values corresponding to the address space on their PCI side. PXB will calculate the size of the "big window" (BAR-limit on primary PXB) based on the BAR and window size. Widow sizes set in +0x40 must be the same for primary and secondary PXBs.

PXB Initialization Example

Below is an example on how to setup registers of two PXB chips so that they provide a PCI-to-PCI bridge across a RACEway interlink (ILK4).

The PXB, in the RACEway slot A, is reffered to as the primary PXB, and the PXB, in the slot B, as the secondary PXB.

The following example creates an 8 Mbytes window, at PCI Memory space addresses 0x80000000-0x807fffff, from the primary to the secondary side i.e. the primary PXB will respond to address cycles between 0x80000000-0x807fffff, and forward them to the secondary side. The secondary PXB will forward transactions in address ranges 0x0 - 0x7FFFFFFF and 0x81000000 - 0xFFFFFFFF, to the primary side.

The initialization values may easily be programmed into the PXB, using PCI Configuration Type 0 cycles. The offsets for each register is given.

PCI-to-PCI Bridge Configuration Space Header Registers of the Primary PXB:

Register	Offset	Value
Device and Vendor ID	0x0	0x00011134
Command and Status	0x4	0x04800007
Class Code + Revision ID	0x8	0x06000000
Misc.	0xc	0x00010000
Base Addr. 0	0x10	0x0
Base Addr. 1	0x14	0x0
Bus numbers and Sec.Lat.Timer	0x18	0x00030100
Sec.Status and IO window	0x1C	0x04800111
Memory Window	0x20	0x00000010
Pref. Memory Window	0x24	0x80f08000
Pref. Base Upper 32 bits	0x28	0x00000000
Pref. Limit Upper 32 bits	0x2c	0x00000000
IO upper	0x30	0x00000000
Reserved	0x34	0x00000000
Exp. ROM Base Address	0x38	0x00000000
Bridge and Interrupt Control	0x3c	0x00000100
PXB Bridge Control	0x40	0x10880826
Memory window	0x44	0x00000000
EEPROM register	0x48	0x0000f773
.	0x4c	0x00000000
Mailbox reg.	0x50	0x00000000
Mem. Mask. Reg.	0x54	0x00000000
IO Mask Reg.	0x58	0x00000000
MIO Mask Reg.	0x5c	0x00000000
Subsystem Identification	0x60	0x00000000
PCI Miscon Reg.	0x64	0x00000200
Arbitration Control	0x68	0x00000000

Route Table for the Primary PXB:

Register	Offset	Value
Route for Page 0	0x500	0xc0000000
Return route for Page 0	0x508	0xe0000080
Route for Page 1	0x510	0xc0000000
Return route for Page 1	0x518	0xe0000081
Route for Page 2	0x520	0xc0000000
Return route for Page 2	0x528	0xe0000082
Route for Page 3	0x530	0x c0000000
Return route for Page 3	0x538	0x e0000083
Route for Page 4	0x540	0x c0000000
Return route for Page 4	0x548	0x e0000084
Route for Page 5	0x550	0x c0000000
Return route for Page 5	0x558	0x e0000085
Route for Page 6	0x560	0x c0000000
Return route for Page 6	0x568	0x e0000086
Route for Page 7	0x570	0x c0000000
Return route for Page 7	0x578	0x e0000087
Route for Page 8	0x580	0x a0000000
Return route for Page 8	0x588	0x e0000088
Route for Page 9	0x590	0x a0000000
Return route for Page 9	0x598	0x e0000089
Route for Page 10	0x5a0	0x a0000000
Return route for Page 10	0x5a8	0x e000008a
Route for Page 11	0x5b0	0x a0000000
Return route for Page 11	0x5b8	0x e0000000
Route for Page 12	0x5c0	0x 80000000
Return route for Page 12	0x5c8	0x e0000000
Route for Page 13	0x5d0	0x 80000000
Return route for Page 13	0x5d8	0x e0000000
Route for Page 14	0x5e0	0x 80000000
Return route for Page 14	0x5e8	0x e0000000
Route for Page 15	0x5f0	0x 80000000
Return route for Page 15	0x5f8	0x e0000000

PCI-to-PCI Bridge Configuration Space Header Registers of the Secondary PXB:

Register	Offset	Value
Device and Vendor ID	0x0	0x00011134
Command and Status	0x4	0x04800007
Class Code + Revision ID	0x8	0x06040000
Misc.	0xc	0x00010000
Base Addr. 0	0x10	0x0
Base Addr. 1	0x14	0x0
Bus numbers and Sec.Lat.Timer	0x18	0x00020201
Sec.Status and IO window	0x1C	0x04800111

Memory Window	0x20	0x00000010
Pref. Memory Window	0x24	0x80708000
Pref. Base Upper 32 bits	0x28	0x00000000
Pref. Limit Upper 32 bits	0x2c	0x00000000
IO upper	0x30	0x80708000
Reserved	0x34	0x00000000
Exp. ROM Base Address	0x38	0x00000000
Bridge and Interrupt Control	0x3c	0x00000000
PXB Bridge Control	0x40	0x00800820
Memory window	0x44	0x00000000
EEPROM register	0x48	0x00005550
.	0x4c	0x00000000
Mailbox reg.	0x50	0x00000000
Mem. Mask. Reg.	0x54	0x80400000
IO Mask Reg.	0x58	0x80400000
MIO Mask Reg.	0x5c	0x00100000
Subsystem Identification	0x60	0x00000000
PCI Miscon Reg.	0x64	0x00000700
Arbitration Control	0x68	0x00000020

Route Table for the Secondary PXB:

Register	**Offset**	**Value**
Misc. Control	0x418	0x00020000
Route for Page 0	0x500	0xe0000008
Return route for Page 0	0x508	0xc0000000
Route for Page 1	0x510	0xe0FFFFFF
Return route for Page 1	0x518	0xFFFFFFFF
Route for Page 2	0x520	0xFFFFFFFF
Return route for Page 2	0x528	0xFFFFFFFF
Route for Page 3	0x530	0xFFFFFFFF
Return route for Page 3	0x538	0xFFFFFFFF
Route for Page 4	0x540	0xFFFFFFFF
Return route for Page 4	0x548	0xFFFFFFFF
Route for Page 5	0x550	0xFFFFFFFF
Return route for Page 5	0x558	0xFFFFFFFF
Route for Page 6	0x560	0xFFFFFFFF
Return route for Page 6	0x568	0xFFFFFFFF
Route for Page 7	0x570	0xFFFFFFFF
Return route for Page 7	0x578	0xFF000000
Route for Page 8	0x580	0x a0000008
Return route for Page 8	0x588	0x c0000000
Route for Page 9	0x590	0x a0000008
Return route for Page 9	0x598	0x c0000000
Route for Page 10	0x5a0	0x a0000008
Return route for Page 10	0x5a8	0x c0000000
Route for Page 11	0x5b0	0x a0000008
Return route for Page 11	0x5b8	0x c0000000

Route for Page 12	0x5c0	0x a0000008
Return route for Page 12	0x5c8	0x c0000000
Route for Page 13	0x5d0	0x a0000008
Return route for Page 13	0x5d8	0x c0000000
Route for Page 14	0x5e0	0x a0000008
Return route for Page 14	0x5e8	0x c0000000
Route for Page 15	0x5f0	0x a0000008
Return route for Page 15	0x5f8	0x c0000000